

# **Rapid Soil Carbon Assessment of the U.S. for Conservation Planning and Model Validation**

National Cooperative Soil Survey

# Why Carbon Data?

- ▶ Reliable estimates of the amount of carbon that can be practically stored in soil
  - Soil
  - Land use, ag management systems, ecological site and state
- ▶ Need quantitative data
  - Decision support tools such as COMET-VR
  - Carbon cap and trade programs
  - Global carbon accounting
  - Model calibration

# Objectives

- ▶ Evaluate US soil carbon stocks as effected by
  - Soil
  - Land cover
  - Agricultural management
  - Ecosystem state
- ▶ Inventory total and distribution of soil carbon stocks for U.S.

# Phase 1

## National Soil Carbon Inventory Developed from SSURGO

Short-term Product



# STATSGO SOC Estimates

1:250,000 scale; published in 2001

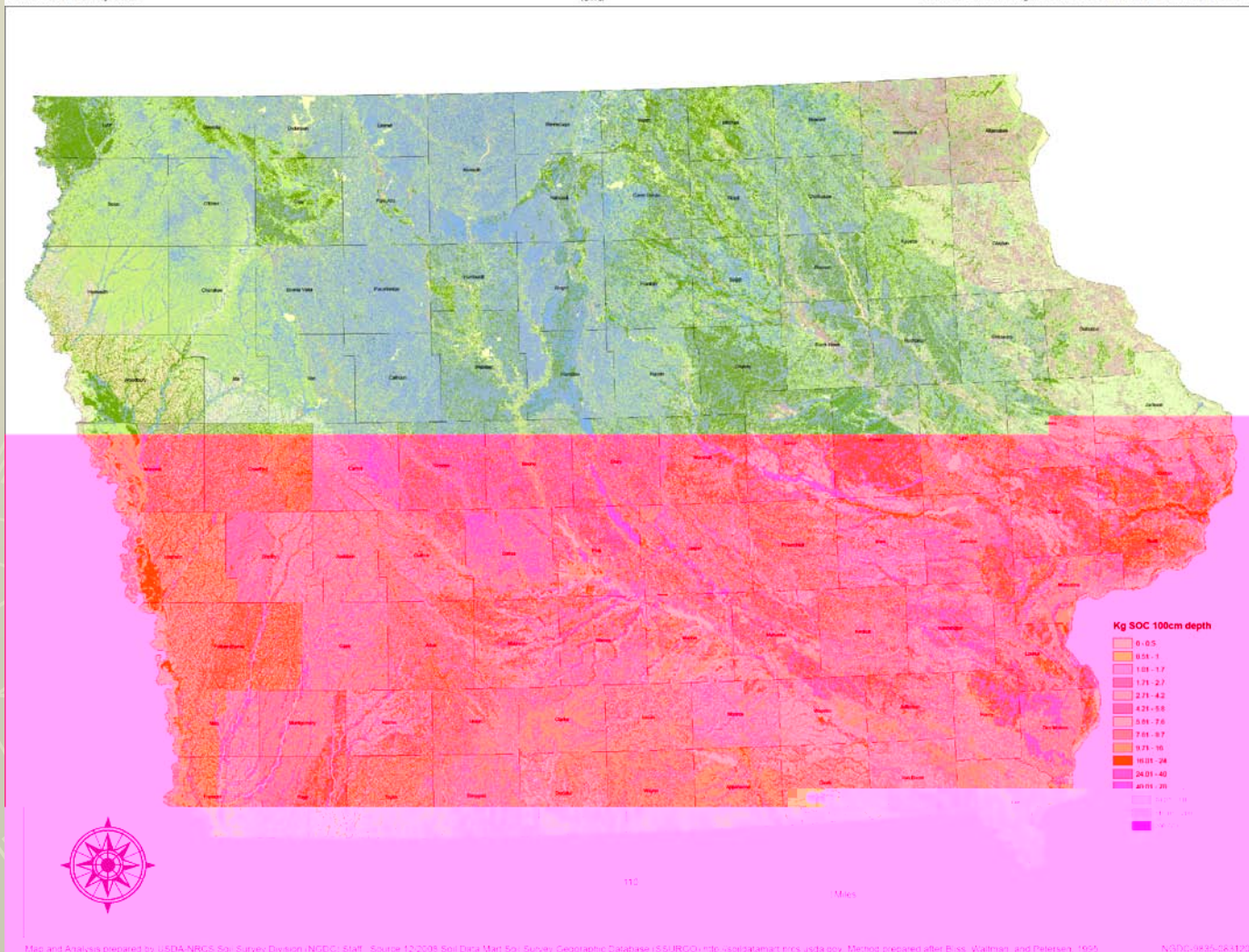


# SSURGO SC Estimates to 1 m

Detailed Soil Survey Atlas

Iowa

NGDC Staff Soil Organic Carbon Calculation - DRAFT 08312008



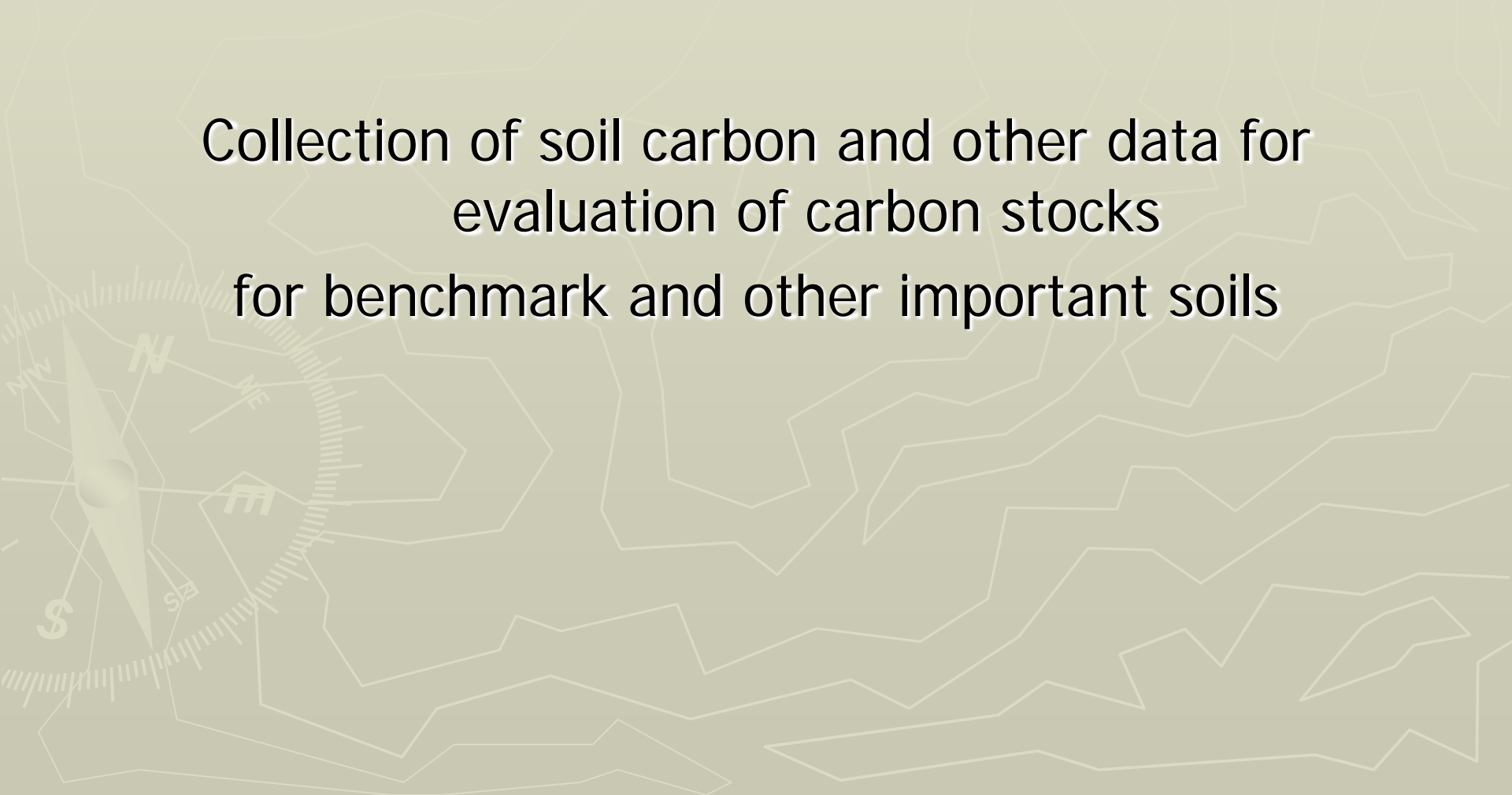


# SSURGO SC Estimates to 1 m

- ▶ Not just organic C – will include estimates of inorganic C ( $\text{CaCO}_3$ )
- ▶ Adjust organic C and bulk density for land cover data
  - ▶ SSURGO – low, representative value (RV), high
  - ▶ RV value for “dominant” land use for map unit
  - ▶ Adjust carbon stocks based on land cover
- ▶ Evaluate estimates with NSSC pedon data

# Phase 2

Collection of soil carbon and other data for  
evaluation of carbon stocks  
for benchmark and other important soils





# Nationwide Effort

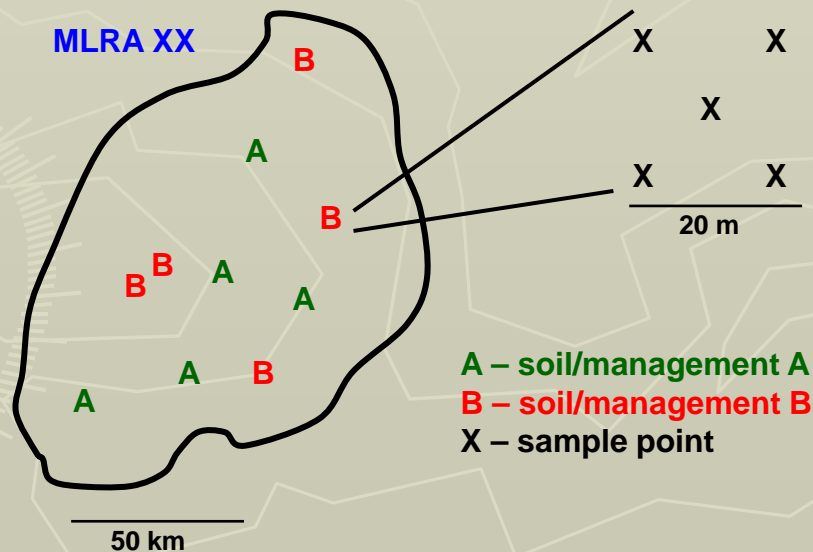
- ▶ All land uses and ecosystems
  - Cropland
    - ▶ Tillage systems
  - Pasture
  - Range
  - Forest
  - Wetlands
  - Floodplains

# Sample Stratification

- ▶ Soil
  - ▶ Groups based on benchmark and other important soils
    - ▶ Similar effect on C dynamics
- ▶ Land use/management/ecosystems within soil
  - ▶ Steady state conditions
    - ▶ End product – not rate

# Replication for Statistical Confidence

- ▶ NCSS pedon data suggests need about 25 replicates (sample points) per soil-ecosystem combination for 80% confidence in mean
- ▶ Clustered sample design
- ▶ More replicates for extensive soil groups



# How much data can we collect?

- ▶ Dispersed analysis
  - 18 MO regions
  - 400 sites/MO
  - ~7,000 sites
    - ▶ 1-2 sites per county
  - 35,000 sample points
- ▶ ~1,400 soil-land cover combinations
  - 80 per MO region
    - ▶ 7 land covers
    - ▶ 11 soil groups

# Sites

- ▶ Randomized NRI points within appropriate map units
  - Soil group confirmed on site
  - Steady-state ecological state/management system confirmed
- ▶ Site identification being finalized
- ▶ May also be used for ESD state and transition model data collection

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  - Vegetation
  - Dynamic soil properties

# Data Collection

- ▶ By horizon to 1 m
  - 0-5 cm surface sample
- ▶ Landscape properties
- ▶ Soil morphology
- ▶ Total and inorganic C
- ▶ Bulk density
- ▶ Rock fragments
- ▶ Dispersed data collection
  - ▶ 120-140K samples
  - ▶ VNIR



# Dispersed Data Collection

- ▶ Soil scientists in 18 MO Regions
  - ▶ 1 VNIR spectrometer per MO
  - ▶ 1-2 soil scientists trained on VNIR and sampling protocol
  - ▶ Assistance from other soil scientists in MO
  - ▶ Consistency in methods is critical
- ▶ NSSC staff
  - VNIR model development
  - Data storage and analysis
  - Training
  - QA

# Additional Data

- ▶ Want to consolidate as much existing data as possible
  - ▶ Specific management effects
  - ▶ Rates of change with LULC/management effects
- ▶ ARS research sites
- ▶ University research sites
- ▶ EPA National Wetland Condition Assessment
- ▶ Existing pedon data (NCSS database)